SEMESTER END EXAMINATION APRIL-MAY, 2026

Course Name: B.Tech. **Semester: IV**

Paper Name: P.T. and S.P. **Paper Code: NEC 404**

Time - 3 Hrs + 20 minutes per hour extra time for V.I. & examinees with writer. **Max Marks-70**

Instructions:

- The question paper consists of three sections namely A, B, C. All sections are compulsory.
- Section A- Each question carries **3 mark. All questions are compulsory**.
- Section B- Answer any **5 out of 7** given questions. Each question carries **7 marks**.
- Section C- Answer any **2 out of 3** given questions. Each question carries **10 marks**.

Section – A

Multiple Choice Questions

1. Answer all the following questions. **5x3 =15**

i) The probability density function f(x) is given by

a) $\frac{d}{dx}F(x)$

b) $\int F(x)dx$

c) $e^{f(x)}$

d) None of the above

ii) The cardinality of real numbers is

a) n

b) N_0

c) c

d) d

iii) For the probability distribution

X	0	1	2
f(x)	0.7	0.2	0.1

The expected value of X is

a) 1.2

b) 2.1

c) 0.4

d) 1.0

iv) The random variable is said to be mean ergodic if $\sigma_x^2 =$

a) 0

b) 1

c) 2

d) 3

v) A random process is said to be stationary if all statistical properties does not change with

a) Average

b) Frequency

c) Time

d) None of the above

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Section - B
Short Answer Questions

2. Answer any five of the following questions. **5x7=35**

i. In a bolt factory machines A , B and C manufacture respectively 30 %, 25% and 45% bolts of the total output. Out of these 4%, 3% and 2% are defective bolts. A bolt is drawn at random from product and is found to be defective. What is the probability that is was manufactured by machine A.

ii. Show that the set of real numbers is uncountable.

iii. Explain the concept of random process.

iv. A Random variable x has the following probability function:

X	-2	-1	0	1	2	3
P(x)	0.1	K	0.2	3k	2k	0.3

(a) Find the value of K

(b) Find $P(-2 < X < 1)$ and $P(X \geq 0)$

v. Find the probability density function for the random variable whose distribution function is given by $F(x) = \begin{cases} 0 \; for \; x \leq 0 \\ x \; for \; 0 < x < 1 \\ 1 \; for \; x \geq 1 \end{cases}$. Also obtain their graphs.

vi. If $f(x,y) = \begin{cases} \frac{3}{5}x(y+x) \; for \; 0 < x < 1, 0 < y < 2 \\ 0 \; elsewhere \end{cases}$ is the joint probability function of two random variable X and Y. Find $P[(X,Y) \in A]$. Where A is the region $\{(x,y): 0 < x < \frac{1}{2}, 0 < y < 1/2\}$

vii. State and Prove Chebyshev's inequality.

Section - C
Descriptive Questions

3. Answer any two of the following question. **2x10=20**

i) Explain moment generating function of Normal Distribution.

ii) If the joint probability distribution of two discrete random variable given as follows:

X→ Y↓	0	1	2
0	3/28	9/28	3/28
1	3/14	3/14	0
2	1/28	0	0

Find the marginal probability distribution of x and y.

iii) Explain briefly about time average and ergodicity.

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